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NATURAL HISTORY OF PLUMMERS ISLAND,
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XIV. BIOLOGICAL NOTES AND DESCRIPTION OF THE LARVA AND PUPA
OF *COPELATUS GLYPHICUS* (SAY) (COLEOPTERA: DYTISCIDAE)

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The genus *Copelatus* is primarily tropical or subtropical in distribution but in the Western Hemisphere a few species occur throughout much of the temperate region of the United States. One of these is *Copelatus glyphicus* (Say), commonly found in the Eastern United States. Adults of this species are collected frequently; however, the immature stages have not been described. The larva and pupa of this common species are described in this paper.

On 7 June 1961, numerous larvae and adults of *C. glyphicus* were collected from a water-filled pothole in an outcropping of rock on Plummers Island, Md. The pothole was exposed to direct sunlight most of the day and the water temperature reached 82° F at noon. The water was darkly colored from decomposing vegetation. Larvae dipped from the water temporarily feigned death but soon hastily burrowed into the debris in the net.

By rearing last instars to the adult stage, the immature stages were identified as those of *C. glyphicus*. The larva and pupa closely resemble those of *Copelatus parvulus* (Boisduval), a Hawaiian species, whose immature stages were described by Williams (1936).

By dissecting the gut of larvae and adults of *parvulus*,

¹ For the list of numbers I-XII of this series see Krombein, 1959, Proc. Biol. Soc. Washington 72: 101-102. For number XIII see the preceding paper by Krombein in this issue. Publication costs of this number have been defrayed by the Washington Biologists' Field Club to promote its primary objective of research on the flora and fauna of Plummers Island and adjacent areas.

Williams (1936) found that they fed on copepods and ostracods and that they possessed a trilobed proventriculus. My dissections of four *glyphicus* larvae showed that this species also has a trilobed proventriculus and eats copepods, ostracods, ceratopogonid larvae, and the collembolan *Podura aquatica* L.

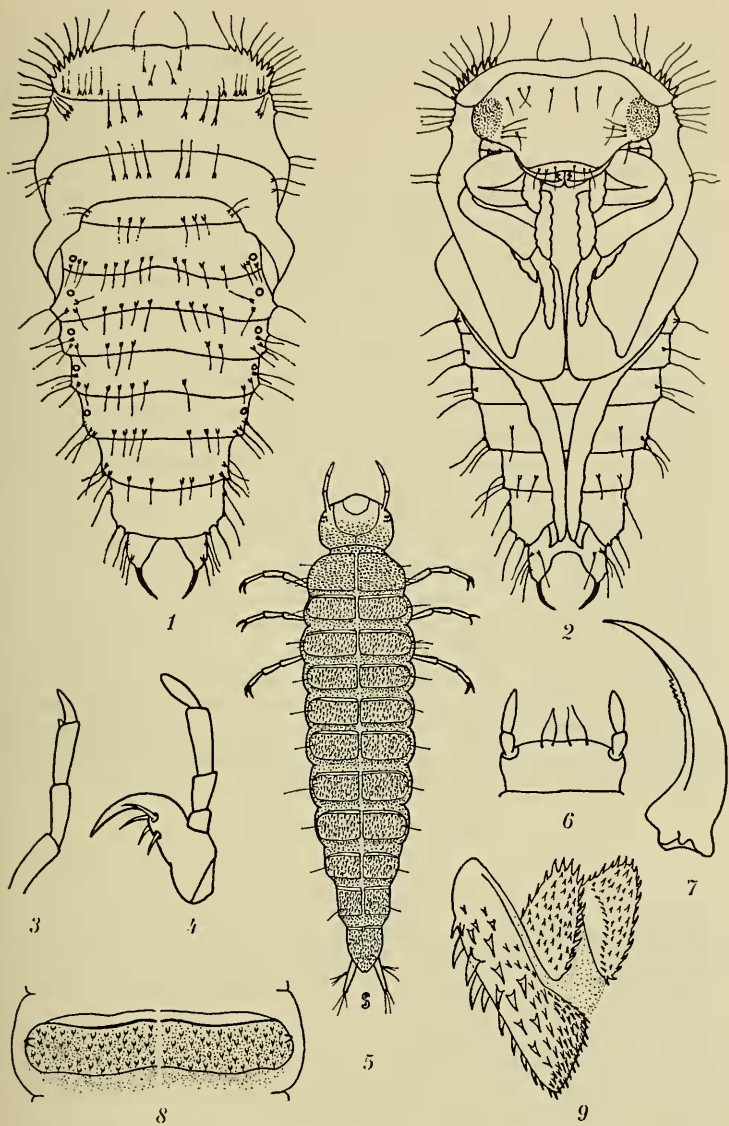
On 13 June, I examined the soil around the roots of moss growing alongside the pothole previously mentioned and found a pupa lying in the damp soil. A small depression in the soil indicated that a pupal chamber was present but this depression was disturbed when I separated the moss from the soil. When found, the pupa was entirely white; but when examined 7 hours later, the eyespots had become pink, which suggested that pupation had occurred earlier on the same day the pupa was collected. The pupa was kept for rearing and it eclosed 6 days after it was collected. Six larvae brought back to the laboratory pupated in the soil surrounding the roots of moss. The first pupa was preserved and used for descriptive purposes. Three of the five remaining pupae were preserved for the U. S. National Museum collection and the other two were allowed to eclose. Ecdysis occurred on the fifth and sixth day, respectively, after pupation.

On 6 September, I again found *glyphicus* larvae in a pothole. At that time 12 larvae in different stages were collected and they have been deposited in the U. S. National Museum collection. Apparently this species breeds throughout most of the summer. Adults have been collected on the island as early as 4 March and as late as 11 October.

DESCRIPTION OF LAST INSTAR
(Figs. 3-9)

Length 7.5 mm; greatest width of pronotum 1.1 mm. Color of integument gray; terga grayish brown with yellowish brown maculae on mesonotum and metanotum; a median longitudinal stripe also is yellowish brown. Terga and integument behind terga asperate. Body subdepressed and elongate.

Head subquadrate. Labro-clypeus evenly arcuate, with a row of seta-bearing punctures along anterior margin; labro-clypeal suture present, distinct. Ecdysial cleavage line distinct at base of head, abruptly forked at basal third of head and frontal arms of cleavage line then diverge weakly and extend to anterior edge of labro-clypeus at base of mandibles. Ventral surface of head with a few long setae; posterior tentorial pits present. Ocular area with six ocelli arranged in an ellipse; anterior three



FIGS. 1-9. *Copelatus glyphicus* (Say): FIG. 1.—pupa, dorsal view. FIG. 2.—pupa, ventral view. FIG. 3.—antenna. FIG. 4.—maxilla. FIG. 5.—larva, dorsal view. FIG. 6.—labium. FIG. 7.—mandible. FIG. 8.—second tergum. FIG. 9.—trilobed proventriculus (slide mount, slightly distorted).

ocelli compact, adjacent; posterior three separated so that ventral ocellus is widely separated from remaining two dorsal ocelli. Antenna four-segmented, moderately long, cylindrical; first and penultimate segments equal; second shorter; ultimate segment shortest, about half length of penultimate. Both mandibles long, moderately stout, falciform; upper, inner edge distinctly serrate (7 teeth) in middle portion, lower inner edge with minute serrate area (4 teeth) (not present in all larvae examined). Maxillary stipe broad; galea very long; lacinia with four spine-like processes, two on dorsal side and two on ventral side at base of lacinia; palpus four-segmented, basal segment shortest, second segment slightly longer than basal, ultimate and penultimate segments longest and subequal. Labium without ligula; labial palpus two-segmented, second segment longer.

Pronotum with sides arcuate, widest posteriorly, lateral margins with a few (8-10) long setae. Mesonotum wider than pronotum but only slightly more than half as long as pronotum; with interspersed setae arising from spinous bases; with a pair of spiracles anterior to mesocoxae in pleural region. Metanotum slightly wider than mesonotum and subequal in length, setation similar to mesonotum.

Legs five-segmented; coxa long; trochanter about a third as long as coxa; femur longer than tibia; tarsus with two elongate, slender claws. No natatory hairs present on legs.

Abdomen with eight distinct segments. Each segment with setation similar to metanotum and with a well-developed antecostal suture which is briefly interrupted medially. Segments 1 to 7 each with a pair of spiracles, one on each side of segment; segment 8 with a pair of terminal spiracular openings above cerci. Segments 7 and 8 narrow rather abruptly and are sclerotized ventrally but less than dorsally. A pair of unsegmented cerci arise from ventral side of eighth segment. Each cercus with three setae arising at midlength and three from apex.

DESCRIPTION OF PUPA (Figs. 1-2)

Length 4.5 mm, greatest width 2.0 mm; color white except eyes reddish brown; glabrous except for styli described below.

Head with 22 styli arranged as follows: 4 styli between eye and vertex (only 3 on left side), 5 at lower anterior corner of eye (only 4 on right side), and 6 on clypeus.

Pronotum with 39 styli arranged as follows: 9 on right anterolateral angle, 8 on left anterolateral angle, 1 on each side of median line on anterior margin, 6 on each posterolateral angle, 2 on each lateral margin, and 2 on each side of median line on disc.

On the dorsum of several of the remaining segments, some groups of styli are unequal in number on opposite halves of the pupa; therefore, a numerical formula is used that gives the number of styli in each group from the left side of the segment to the right. First and last numbers thus refer to lateral groups and the middle numbers refer to groups on

each side of the median line. When only two numbers are given, these refer to lateral groups. The arrangement of styli is as follows: Mesonotum, 3-3-3-2; metanotum, 2-4-3-2; first abdominal, 2-3-3-2; second abdominal, 3-5-4-3; third abdominal, 3-4-4-2; fourth abdominal, 3-3-2-3; fifth abdominal, 3-4-1-3; sixth abdominal, 3-4-3-3; seventh abdominal, 3-2-3-3; eighth abdominal, 2-4.

Segment 9 terminates in two cerci longer than length of eighth segment; each cercus with two dorsal and two ventral styli.

Abdominal segments, 2, 3, and 4 ventrally each with two styli, one on each side of segment; segments 5 and 6 each with four styli, one lateral and one each side of median line.

First to sixth and apparently seventh abdominal segments with a pair of spiracles.

Antennae and legs extend outward at right angles from body axis. Tibiae of first two pairs of legs folded against femora; tarsi turned backward parallel with body axis. Femur and tibia of each hind leg not folded against each other; femora directed obliquely away from midline; tibiae directed obliquely toward midline; tarsi almost parallel with body axis.

Variation: The four pupae showed a surprising amount of variation in the number of styli on the different parts of their bodies. When the numbers of styli were averaged, the normal complement appeared to be as follows: Head with 4 styli between eye and vertex, 5 below lower corner of eye, and 6 on clypeus (total on head 24); pronotum with 10 styli on each anterolateral angle of pronotum, 2 on anterior edge, 4 on disc, 2 on each lateral margin, and 6 on each posterolateral angle (total on pronotum 42); mesonotum, 3-3-3-3; metanotum, 2-4-4-2; dorsum of first abdominal segment, 2-3-3-2; second abdominal, 3-4-4-3; third abdominal, 3-4-4-3; fourth abdominal, 3-4-4-3; fifth abdominal, 3-4-4-3; sixth abdominal, 3-4-4-3; seventh abdominal, 3-3-3-3; eighth abdominal, 4-4.

Four pupae and 22 larvae have been deposited in the United States National Museum collections.

REFERENCE

Williams, Francis X. 1936. Biological studies in Hawaiian water-loving insects, Part I, Coleoptera or beetles. Proc. Hawaiian Ent. Soc. 9(2): 235-273.